

# Preparation of Mixed-monolayers of Isocyanide Molecules on Gold Surface Aiming for Concerted Catalysis †

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**Abstract:** Many active sites in enzymes consist of multiple active centers such as acidic and basic functionalities. Concerted catalysis is realized by synergistic function among these multiple active centers. In this study, we envisioned preparing mixed monolayers consisting of two organic molecules to present both acidic and basic functional groups on a gold surface, expecting that these two functional groups behave synergistically to show concerted catalysis. Isocyanide group was selected as a functional group to form a self-assembled monolayer on a gold surface. Isocyanide molecules containing either a carboxyl group or a dimethylamino group acting as an acid or base were synthesized. Immersion of gold surface in mixed ethanol solutions of the synthesized two isocyanide molecules in various mixing ratios was conducted to form mixed monolayers on the gold surface. The structures of prepared monolayers were analyzed by XPS measurements. The XPS analyses confirmed the formation of mixed monolayers and provided the ratios between the two molecules and the surface molecular densities on gold. The mixed monolayers prepared in this study were applied to aldol reactions. It is expected that screening of reaction and optimization of mixed monolayer structure will lead to observing concerted catalysis.

**Keywords:** concerted catalysis; isocyanide; self-assembled monolayer; gold surface; aldol reaction.

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### **Conflicts of Interest**

The authors declare no conflict of interest. Takamitsu Kawamata collected and analyzed the experimental data. Kenji Hara decided to publish the results. Both of them were involved in the design of the study, interpretation of data, and writing of the manuscript.